# MESOZOIC INSECTS OF QUEENSLAND.

## No.6. Blattoidea.

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(Text-figs. 29-40).

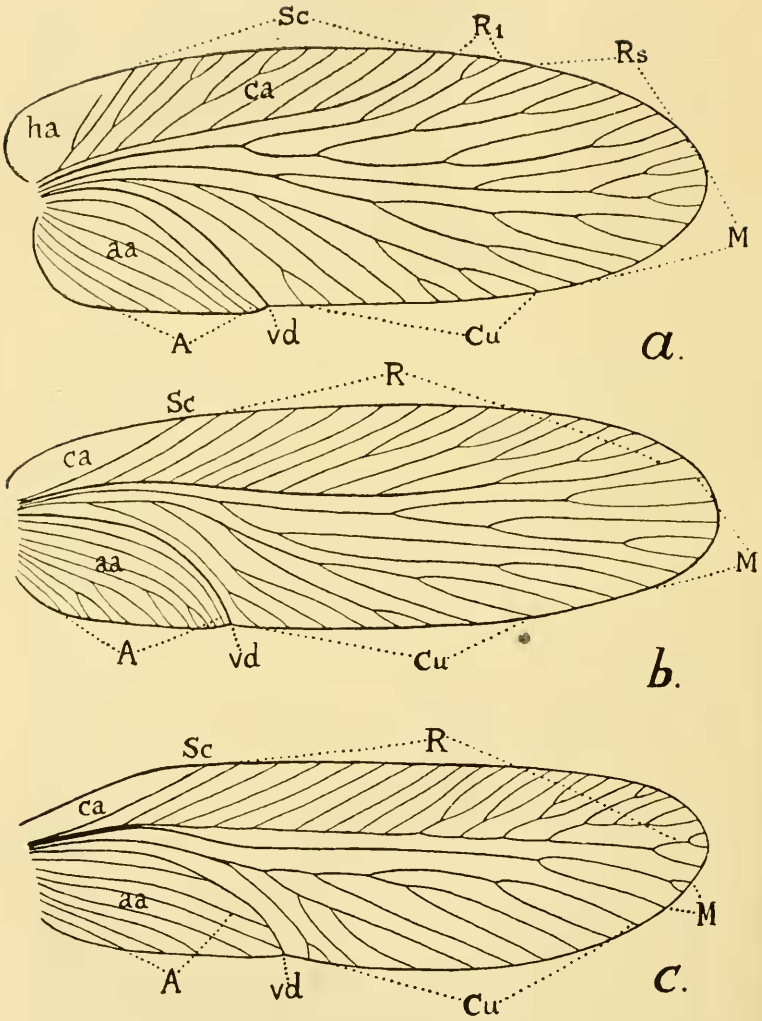
Although regarded by many entomologists as forming only a single family, or at most a Suborder, within the Order Orthoptera, the Cockroaches comprise the vast majority of the known fossil insects of Palæozoic times, and were evidently the dominant group during the Upper Carboniferous and Permian of the Northern Hemisphere. Consequently, they have come to be studied apart from the rest of the Orthoptera; and many attempts have been made to indicate for them characters of ordinal value, which should set them completely apart from the rest of that Order. Such characters are to be found in the oval, much flattened body; the large oval pronotum, beneath which the head is almost wholly concealed; the huge coxæ; the similarity in the structure of all three pairs of legs; and especially in the shape and venation of the tegmina or forewings. I must confess my inability, at present, to see anything of more than subordinal value in all these characters. The Cockroaches appear to me to be essentially the most generalised of Orthoptera; and I propose to use the group-term Blattoidea as indicating a distinct, archaic Suborder within the Order Orthoptera.

The great majority of fossil cockroaches are represented either by a single tegmen, or part of it, or at most by the two tegmina *in situ*, folded down the back of the insect. Hindwings are comparatively rare, owing to their much greater delicacy of texture, and the slight chance of their being preserved intact, or, if preserved, of leaving any reasonably clear impression upon the rock in which they become imbedded.

The study of fossil cockroach tegmina is almost a special branch of Entomology by itself, and has been brought to considerable perfection by Scudder, Brongniart, Handlirsch, and others. For the purpose of dealing adequately with the fossil Blattoidea so far found at Ipswich, it would appear sufficient if we indicated the typical venational scheme of a cockroach tegmen, and pointed out the main lines of specialisation which are shown in the evolution of this type of forewing, from its first occurrence in the Upper Carboniferous, down to the present day.

Text-fig.29 shows three very typical cockroach tegmina, one from the Upper Carboniferous of Europe, another from the Lias of Europe, and a third from a still existing genus of Australian cockroaches. All three agree in the general shape of the tegmen, though it may be said that the average breadth, in comparison with the length, is greatest in the oldest forms, and decreases as we pass up through the Mesozoic forms to those of the present day. All three likewise agree in the very definite marking off of a somewhat cultriform *anal area* or *clavus*. This character is one of the most distinctive of the true cockroach tegmen, and the area in question is generally excellently preserved in fossils.

The differences between the three types are fairly obvious. In the Carboniferous fossil, the subcostal vein (Sc) was well developed, sending many branches to the anterior border of the wing, and occupying at least half of that border. The only space devoid of branch-veins is a small portion of the costal area, at its extreme base, which we may term the *humeral area* (Text fig.29*a*, *ha*). The space lying between the anterior border of the tegmen and the main stem of the subcosta, and including, therefore, not only the humeral area proper, but also the whole area supplied by branches of Sc, is the true *costal area* (Text-fig. 29, *ca*). In the Mesozoic and recent types figured, the subcosta becomes reduced to a simple vein, which borders the costal area distally; and the latter becomes, like the humeral area of the older type, free of branch-veins. There are, of course, many Carboniferous types that show stages in this reduction; but they are not dominant types for that period. Thus the *Poroblattinidæ*




Text-fig. 29.

Venation of Blattoid tegmina. *a*. Genus *Phyloblatta*, family *Archimylacridæ* (diagrammatic). Upper Carboniferous of Commentry, France. *b*. *Rhipidoblatta geikiei* Scudder, family *Mesoblattinidæ* (enlarged from Handlirsch), Lias of Moreton Bagot, England. *c*. *Escala circumducta* (Walker), family *Blattidæ*, recent, Australia (×$7\frac{1}{2}$).

show the subcosta reduced to a few veins—an intermediate stage between *Phyloblatta* (Text-fig.29*a*) and *Rhipidoblattina* (Text-fig. 29*b*). This latter genus belongs to the *Mesoblattinidæ*, which, represented by only three genera in the Upper Carboniferous, become more important in the Permian, and finally reach the dominant position among Mesozoic Blattoids.

Let us next consider the radius (R). In the type exhibited by *Phyloblatta*, we can usually indicate the boundaries of the main stem of R ($R_1$) and the radial sector (Rs) respectively. Thus these cockroaches fall into line with almost all other insects in this respect. But when the radius supplants the subcosta, as in the Mesozoic and recent forms, it tends more and more to take on the original character of that vein, viz., a single, gently curving main stem, giving off only anterior branches to the wing-border. There are many forms in which this process can be seen uncompleted; yet, in general, we may say that the limits of $R_1$ and Rs become no longer clearly evident, and it is best to consider the radius, for purposes of description, as a single main stem with many anterior branches.

The media (M) tends to alter very little throughout all Palæozoic and Mesozoic forms. It always supplies about the same area of the wing, viz., a more or less triangular area covering the middle line of the tegmen, including the apex and portion of the wing-border below it. In the recent form figured (Text-fig.29*c*), the media is shown much reduced, and fused basally with the radius. A reduced media is found in a few Mesozoic forms, but its basal portion is never fused with R in these fossils. There are also many genera still existing in which the media remains free and many-branched.

The cubitus (Cu) also tends to alter very little. In the great majority of forms it supplies the broadly triangular area lying below the middle line, sending branches to the posterior border, from below the most posterior branch of M to near the anal area. The manner and number of these branches is very variable in all forms.

The most characteristic structure in all Blattoid tegmina is the sharply marked-off *anal area* or *clavus* (Text-fig.29, *aa*). This

somewhat cultriform area is separated from the rest of the tegmen by a deeply impressed vein, called the *vena dividens* (*vd*). This vein, in the Comstock-Needham system, must be either $Cu_2$ or 1A; but, as it does not seem to be quite clear, as yet, which of these it really is, it is best to keep to the non-committal name still in use with students of the Blattoidea. The anal area itself is more or less convex, and hence it is usually very well preserved in fossils, making a deep impression on the rock, much as a Coleopterous elytron does.

The veins supplying the anal area are termed either *anal veins* or *axillaries* (Text-fig. 29, A); we shall adopt the former term. In the Palæozoic fossils, they all spring from the base, and take a more or less oblique course towards the posterior border; none of them ends upon the *vena dividens*. The same is true of most Mesozoic fossils, though occasionally one, or perhaps two, of the more anterior ones may be found to end up on the *vena dividens*, just above the apex of the anal area. Recent forms with the same condition still exist; but there are also many forms in which, as in the one figured in Text-fig. 29*c*, the anal veins distribute themselves alike equally to the *vena dividens* and the posterior border, or even run mostly longitudinally to the former only.

We may add to this account that, in the great majority of Carboniferous fossils, there is a delicate close network of cross-veins all over the tegmen; this is apparently a specialisation from the older and more irregular palæodictyopterous meshwork, or *archedictyon*, found in the Palæodictyoptera, Protorthoptera, and Protoblattoidea. Intercalated veins are very rarely developed. In the Mesozoic fossils, on the other hand, intercalated veins are often well developed, while the close network of cross-veins is more rarely found. Most recent forms have the intercalated veins well developed; and there still exist a number with the cross-venation persisting, though it is seldom of so close a type as in the Carboniferous forms.

Thus, although the Blattoid type of tegmen has remained remarkably stable through many millions of years, we are yet able to see the general trend of evolution, as shown by the

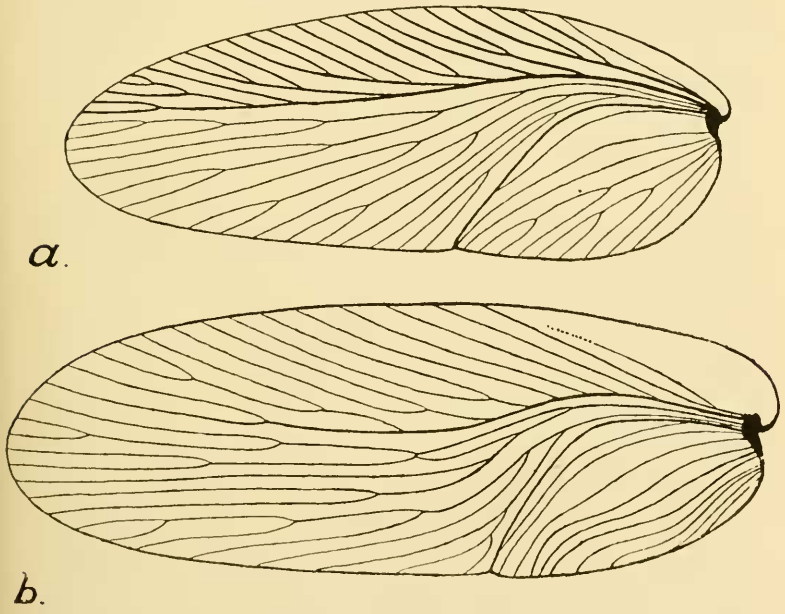
changes in the dominant types at each period. We may sum up these tendencies as follows :—

(1) Tendency towards narrowing of the tegmen.

(2) Tendency towards reduction of Sc, and invasion of the anterior border of the wing by branches from R.

(3) A correlated early tendency towards loss of the clear distinction between $R_1$ and Rs.

(4) Tendency for the anal veins to migrate distally from their original endings on the posterior margin of the wing, and to end instead upon the *vena dividens*.




Text-fig. 30.

Restoration of the tegmen in *a. Triassoblatta typica*, n.g. et sp., and *b. Samaroblatta reticulata*, n.g. et sp. Both from Upper Trias of Ipswich, Q. ($\times 7\frac{1}{2}$). In *b*, the intercalated ridges and cross-venation are omitted.

We are now in a position to study our new Ipswich fossil Cockroaches with advantage. Text-fig. 30 shows the restoration of the tegmina of the two principal genera described in this Part.

Of these two, we must select *Triassoblatta* as the older type; because in it, Sc remains still not reduced to its full limit of a single vein bounding the costal space distally. The radius in this genus shows no strong double curving. This genus might reasonably be put into the *Poroblattinidæ* on the character of its subcosta; but in other respects it comes closer to the *Mesoblattinidæ*, so that a slight extension of the definition, as given by Handlirsch, will enable us to include it as the most archaic member of that family. The other genus, *Samaroblatta*, agrees with *Rhipidoblattina* (Text-fig.29*b*) in its completely reduced Sc, but differs from it in the strong double-curving of R, and in the absence of branchings on the anal veins. It goes naturally into the *Mesoblattinidæ*. The same may be said of the third genus *Austroblattula*, of which it does not seem necessary to give a restoration.

The assemblage of forms described in this paper, then, is just such as we might expect to find in beds of Upper Triassic age. We may note, however, the existence of a much more archaic type in these same beds, in the genus *Austromylacrites* Tillyard, described in a former paper (2, p.13).

Before proceeding to enter upon the descriptions of the new fossils, I desire to express my grateful thanks to Dr. A. Eland Shaw, M.R.C.S., F.E.S., of Wynnum, South Queensland, for his valuable help and criticism upon this Part. The manuscript and Text-figures were sent to Dr. Shaw, who studied them carefully, and was able, owing to his great experience in the group, to suggest a number of useful alterations. My chief discussions with Dr. Shaw centred upon two points, viz., the method of counting the branches of R, and the correct naming of the wing-areas. Both these really depend upon the application of the Comstock-Needham system of venational nomenclature to the Blattoidea, which Dr. Shaw is as anxious to see established as I am, though by long use he has accustomed himself to the different notation in vogue amongst Blattidists. As regards the branches of R, it seems to me, after a study of the known fossil types, that it is quite impossible to say what are the limits of $R_1$ and Rs in Mesozoic and recent forms. I have, therefore, expressly

stated that I regard R as a single elongated main stem, from which a series of primary branches comes off anteriorly, meeting the costal border. In counting these branches, I do *not* include the small fork or forks that may be present near the tip of this main stem, because I consider these to be only secondary forkings, of the same nature as the branches of some of the forkings of the primary branches themselves. To take an example: – by reference to Text-fig.29c, I should say that *Escala circumducta* had a radius with thirteen primary anterior branches, the first nine of which are simple, the next four themselves branched or forked. The last primary branch arises just above the forking of M. To make this quite clear, I should add the phrase "excluding the distal forked end of the main stem," which, as will be seen from the figure, divides into three very short veins. This method of description has been followed throughout the paper, and I trust that it will be quite plain.

As regards the naming of the wing-areas, the rule in the Comstock-Needham System is that *each area should be named from the vein that bounds it anteriorly.* This is awkward for the Blattoidea, since it makes the area in which all the branches of R lie, the *subcostal area.* But it is better to put up with this than to make one rule for the Blattoidea and another for those insects in which the branches of R are posteriorly placed. As regards the area served by the branches of Sc, the rule makes it quite clear that the whole area between the costal border and the main stem of Sc must be the true *costal area*, and will contain within itself all the branches of Sc. Hence a new name is needed for the clear basal portion of the costal area which is of such value as a generic character. This I propose to term, in full, *the humeral portion of the costal area*, a term which may conveniently be shortened to *humeral area*, provided it is understood that it is always part of the costal area proper. When Sc becomes a single straight vein, then the humeral area and the costal area coincide, as in *Samaroblatta*, n.g. In some cases, as in *Triassoblatta insignita*, n.g. et sp. (Text-fig.32), the humeral area has its costal border strengthened, and this strong border is continued beyond the first branch of Sc.

## Family MESOBLATTINIDÆ Handl.

Subcosta much reduced. Radial area extensive and strongly developed, sending numerous branches towards the anterior border, and reaching nearly to apex. Media free, dividing into a variable large number of branches directed towards the apical border. Cubitus also free, branching variably, the branches directed towards the posterior border. Anal field large, well-defined, usually somewhat cultriform, with more or less curved veins running chiefly towards the posterior border. Intercalated veins and reticulation or cross-venation may or may not be present. Mostly small to medium-sized forms.

The above definition of the family is a slight modification of that given by Handlirsch (**1**, pp.290, 378, 427), the alterations having been made with a view to the inclusion of one of the new genera from Ipswich, which does not seem to me sufficiently distinct from the described types of the Northern Hemisphere to warrant the formation of a new family for its reception. Besides, the family, as recognised by Handlirsch, already comprises forms from the Upper Carboniferous, the Permian, and the Lias; so that the new forms from the Upper Trias fall naturally into the family, with respect to their geological age, as well as with respect to their characters. The alterations allow forms in which Sc is not reduced to its full extent, and the branches of Cu do not all come off posteriorly, to be retained within the family, and also indicate that the presence of cross-venation is not as exceptional as Handlirsch imagined it to be.

Handlirsch regards the family as directly derivable from the older *Poroblattinidæ*. From the Upper Carboniferous of North America and Saxony he lists three genera, with five species. From the Lower Permian of North America, he gives three genera, with four species (one of these genera, *Nearoblatta*, occurs in both formations). From the Lias of England, Switzerland, and Mecklenburg, he defines no less than ten genera, comprising twenty-four species. Thus the family contains a total of fifteen genera and thirty-three species. Handlirsch also remarks that the family is only poorly represented in the Upper Carboniferous, but becomes more important in the Permian, finally reaching the

dominant position within the Blattoidea during the Lias. We should, therefore, not be at all surprised to find that the cockroaches from Ipswich, with the single exception of the fine genus *Austromylacrites* Tillyard, previously described (2, p.13), fall naturally into this family.

Of the eleven specimens here dealt with, only two (Specimens 121*a-b* and 152) are not named, the former being too poorly preserved, the latter too fragmentary. Of the remaining nine, two cannot be placed with certainty in their correct genera; these are Specimens 216 and 262, the former being a nearly perfect clavus or anal area only, while the latter has neither humeral area nor anal area clearly preserved. The remaining species may be arranged within three genera, on well-defined characters, as shown in the following key : —

(1) Length of humeral area, from base to apex, distinctly less than that of anal area ..... TRIASSOBLATTA, n.g.
Length of humeral area, from base to apex, at least equal to that of anal area ..... .... 2.

(2) Medium-sized tegmina (about 13 mm. long) with the main stem of R fairly strongly double-curved, so that its lowest point of dip reaches almost to the middle line of the tegmen ..... SAMAROBLATTA, n.g.
Small tegmina (less than 10 mm. long), with the main stem of R very slightly curved, its lowest point of dip lying well above the middle line of the tegmen..... AUSTROBLATTULA, n.g.

Genus TRIASSOBLATTA, n.g. (Text-figs.30*a*, 31-33).

Medium-sized to large tegmina from 12 to 21 mm. in length. Humeral area narrow to moderately wide; distinctly less in length, from base to apex, than is the anal area. Sc consisting of a group of sectors, one of which borders the costal area distally, with or without extra branches on that area, but always with at least one branching sector placed distad from it. Main stem of R with very weak double-curving, so that its lowest point of dip lies well above the middle line of the tegmen, and the most distal branch of R reaches almost to the apex. Anal area somewhat cultriform, well-defined, with some at least of the anal veins forking well before their distal ends.

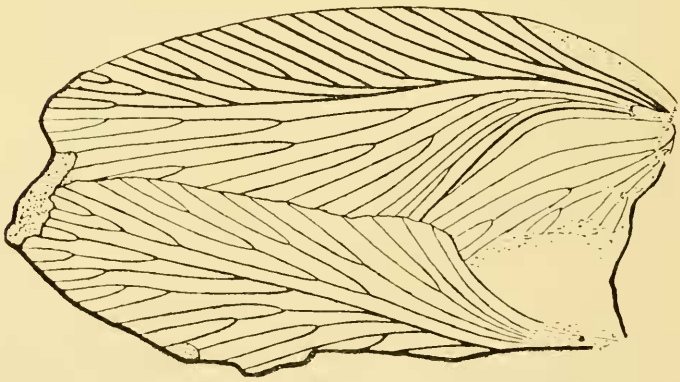
Genotype, *Triassoblatta typica*, n.sp. (Upper Triassic, Ipswich, Q.).

This genus is closely related to *Rhipidoblattina* Handl., from the English Lias, but may be at once distinguished from it by the greater breadth of the tegmen in comparison with its length, and by the absence of intercalated veins and cross-veins.

The two species that can be placed with certainty in this genus may be distinguished as follows : –

Large tegmen (more than 20 mm. long) with definitely strengthened margin to humeral area. Sc with eight branches to border. Anal area with an irregular archedictyon ..... ..... *T. insignita*, n.sp.

Medium-sized tegmen (about 12 mm. long) with humeral area normal, much narrower than in the above. Sc with only four branches to border. Anal area without any reticulation ..... *T. typica* n.sp.



Text-fig.31.

*Triassoblatta typica*, n.g. et sp. (×7½). Left and right tegmina *in situ*. Upper Trias of Ipswich, Q. Drawn from Specimen No.180*a*.

Triassoblatta typica, n.sp. (Text-figs.30*a*, 31).

This specimen is a *mould** of both tegmina *in situ*, the right one almost complete, the left with portions of the costal and

* The impression is a very flat one, but the *vena dividens* lies upon a ridge, thus proving that the fossil is a *mould*, not a *cast*. Consequently left and right sides are interchanged, as in the figure. Dr. Shaw writes : —"Almost invariably in Cockroaches the left tegmen overlaps the right."

posterior borders missing. The apices of both tegmina are also missing. The left tegmen overlaps the right; but, in process of delamination, its extreme posterior border has broken away, leaving somewhat more of the corresponding border of the right tegmen exposed than would otherwise have been the case. Most of the anal area of the right tegmen is well preserved, but the posterior border is missing, as well as, apparently, the whole of this same area in the left tegmen.

Judging from the form of the impression, the insect must have been of considerably broader build than is usually found in existing winged forms amongst Australian cockroaches, even if we allow something for flattening down during fossilisation.

*Greatest length* of fossil, 11·5 mm., representing a tegmen whose *total length* was about 12 mm. *Greatest breadth*, 5·8 mm., representing a total breadth across the two tegmina *in situ* of about 7 mm., and a probable greatest width for a single tegmen of 4·5 mm.

Humeral area narrow, 3·4 mm. long from base to apex, bounded distally by a simple, nearly straight branch of Sc. Distad from this, Sc gives off another sector, which branches into three. Sc, R and its branches are strongly-formed, moderately thick veins. R sends in all seven primary branches towards the anterior border, excluding the distal forked end of the main stem; of these, the first is a forked vein, the second simple, the third forked, the fourth a long vein with four branches, the fifth also a long vein with three branches, the sixth simple, the seventh short with three branches. (This description applies to the right tegmen only; the distribution of the branches in the left tegmen, as far as these are preserved, is somewhat different). Media a moderately strong vein, branching dichotomously again and again, and sending at least nine branches to the wing border at and below the apex. Cubitus also a moderately strong vein, dichotomously branched, sending six veins to the posterior border. *Vena dividens* strongly arched, deeply impressed. Anal area just over 5 mm. long from base to apex, greatest breadth about 3 mm. Of the anal veins the first (most anterior) lies close to the *vena dividens*, and ends up distally upon it; all the

rest apparently end upon the posterior margin of the wing. Second and third anal veins simple, the fourth forking about midway, with an extra distal fork on the anterior branch. The other anal veins not fully preserved, but some of them are evidently forked. Distance between first and second anal veins much greater than that between the others.

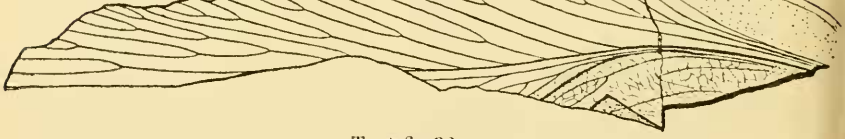
Type, Specimen No.180*a*, with its counterpart No.180*b* (the latter shows only about the basal two-fifths of the tegmina). (Coll. Queensland Geological Survey).

Horizon: Upper Triassic, Ipswich, Q.

TRIASSOBLATTA INSIGNITA, n.sp. (Text-fig.32).

A fragment of a single left tegmen, including almost the whole of the anterior portion from base to apex, with humeral area, Sc and most of R, also the bases of M and Cu, more than half of the *vena dividens*, and the upper portion of the anal area.

*Greatest length*, 19·5 mm., representing a total length for the tegmen of about 21 mm. *Greatest breadth* of fragment, 4 mm., representing an estimated total width of tegmen about 8·5 mm.



Text-fig.32.

*Triassoblatta insignita*, n.g. et sp. (×5·4). Fragment of left tegmen. Upper Trias of Ipswich, Q. Drawn from Specimen No.124.

Humeral area 6 mm. long from base to apex, moderately wide, and having its anterior or costal border strongly thickened; this thickening extends as far as the *third* branch of Sc. First two branches of Sc simple; distad from these follows a long sector giving off four branches; beyond this is another forked sector, so that the total number of branches sent by Sc to the wing-border is eight. Radius apparently gives off six primary branches to the anterior border, exclusive of the forked end of the main stem. Of these, the first is a forked vein, the second simple, the

third again forked, the fourth with three branches, the fifth with four, and the sixth a many-branched vein sending altogether no less than eight branches to the margin of the wing. M and Cu are forked near their bases. *Vena dividens* strongly marked. Anal area, as far as preserved, covered with an archedictyon or primitive palæodictyopterous meshwork of weak, irregular veinlets; the first anal vein lies close to the *vena dividens*, and probably meets it distally; this vein also forks at about half-way; second and third anal veins, as far as preserved, appear to be simple and moderately wide apart.

Type, Specimen No.124. (Coll. Queensland Geological Survey).

Horizon: Upper Trias, Ipswich, Q.

In spite of the fragmentary nature of this fossil, there can be little doubt that it belongs to the genus *Triassoblatta*, since the characters of the costal area, subcosta, and radius agree with the definition, while enough of the anal area is preserved to show that it must have been of considerably greater length, from base to apex, than the completely preserved humeral area.

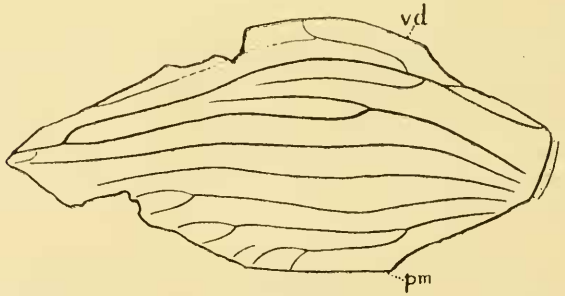
TRIASSOBLATTA(?) INTERMEDIA, n.sp. (Text-fig.33).

This species is represented only by the anal area of a left tegmen, which is almost complete. It may be placed provisionally in this genus, on account of the forking of some of the anal veins, a character shared in common with the two species already described, but absent from the other genera defined in this paper.

*Total length of anal area*, 7·3 mm. *Greatest breadth*, 3·3 mm.

Most of the *vena dividens* missing, but the more anterior part of it (*vd*) preserved. The first anal vein appears to be the weakly formed vein lying just below the *vena dividens*, and connected both with it and with the second anal vein. The latter is a very strong vein, much curved, giving off a posterior branch which does not connect up with any other vein, and anastomosing, near its distal end, with the third anal. The third anal is also a strong vein, giving off an anterior branch which, like the very similar posterior branch of the second anal vein, does not

connect up with any other vein. The fourth and fifth anals are unbranched and nearly straight; the sixth a weaker vein, slightly curved, and with a short distal fork. The seventh is a weak vein, branching into two not far from its base; each branch forks again near its distal end. The fused distal ends of the second and third anal veins appear to end up almost exactly upon the apex of the area; all the veins below these end upon the posterior margin (*pm*). Traces of a true archedictyon are evident in this fossil, but have been omitted from the drawing in Text-fig.33.




Text-fig.33.

*Triassoblatta*(?) *intermedia*, n.sp. (× 11). Left tegmen, anal area. Upper Trias of Ipswich, Q. Drawn from Specimen No.216.

Type, Specimen No. 216. (Coll. Queensland Geological Survey).

Horizon: Upper Trias, Ipswich, Q.

The anal area described above is intermediate in size between those of *T. typica*, n.sp., and *T. insignita*, n.sp., and probably belonged to a tegmen about 18 mm. in length. In showing traces of an archedictyon, it comes closest to the anal area of *T. insignita*. The arrangement and branching of the anal veins is very distinct, and should alone enable us to recognise the species again, if by any chance a more completely preserved specimen be one day found.

Genus SAMAROBLATTA, n.g. (Text-figs. 30*b*, 34-38).

Medium-sized tegmina (about 13 or 14 mm. in length). Humeral area moderately wide, of about the same length, from base to apex, as the anal area. Sc a single, strong, and nearly straight vein bounding the humeral area distally, with or without a weaker, incomplete branch vein proceeding from it on to the humeral area. Main stem of R with fairly strong double-curving, so that its lowest point of dip lies almost upon the middle line of the tegmen, and the most distal portion of R reaches the border well before the apex. Anal area somewhat cultriform, well-defined; forkings of anal veins, if any, confined to small twigs near their distal ends.

Genotype, *Samaroblatta reticulata*, n.sp. (Upper Trias, Ipswich, Q.).

Closely related, by the character of the strong double-curving of R, to *Mesoblattula* Handl., from the Lias of Dobbertin, Mecklenburg; but at once distinguished from it by its much greater size and larger number of veins. The generic name is derived from the word *samara* (Lat. *samera* or *samara*, the seed of the ash), a botanical term indicating the winged mericarp found in the Natural Order Aceraceæ, such as the seed of the maple, sycamore, etc. The appearance of these fossil tegmina, with their strongly impressed basal anal area, is strongly suggestive of this type of winged seed. Parenthetically, it may be mentioned that the venation of quite a number of plant-remains is deceptively like that of the cockroach tegmen, necessitating some care on the part of the investigator of these fossils.

This genus differs from *Triassoblatta*, n.g., not only in the greater comparative length of its humeral area (as given in the key), but also by the simplification of Sc, the much greater double-curving of R, and the absence of any but small distal forkings from the anal veins.

The five species here described may be separated by the following key :—

(1) { Sc, R and its branches strongly thickened veins; M and Cu moderate ..... *S. blabelloïdes*, n.sp.
{ All the veins slender ..... 2.

(2) All the veins, except those of the anal area, separated from one another by broad, strongly developed ridges, resembling thickened veins, but distinguished by not being joined to one another basally ..... 3.
M, Cu and their branches separated by delicate intercalated veins ..... *S. intercalata*, n.sp.

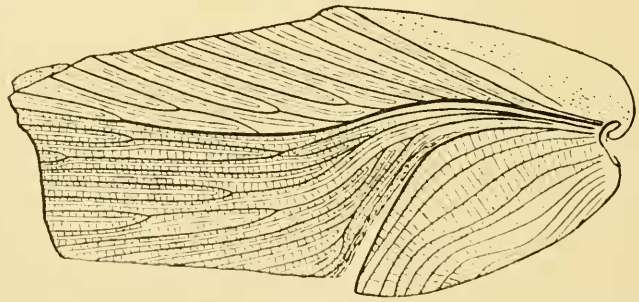
(3) Delicate cross-venation indicated on M, Cu and anal areas... ..... *S. reticulata*, n.sp.
No cross-venation on these areas ..... 4

(4) Anal veins distinct, the third, fourth, and fifth with small distal forkings; delicate cross-venation indicated in region of branches of R ..... *S. triassica*, n.sp.
Anal area with only vestiges of veins; no cross-venation indicated anywhere on the tegmen ..... *S. jonesi*, n.sp.

SAMAROBLATTA RETICULATA, n.sp. (Text-figs.30*b*, 34).

A beautifully preserved left tegmen, complete except for a narrow portion missing from the anterior border, and the whole of the apical portion. Anal area complete, but slightly torn away from the rest of the tegmen along the *vena dividens*.

*Greatest length*, nearly 10·5 mm. *Greatest width*, 4·5 mm. Probable *total length* of tegmen, nearly 14 mm.



Text-fig.34.

*Samaroblatta reticulata*, n.g. et sp. (× 7½). Left tegmen. Upper Trias of Ipswich, Q. Drawn from Specimen No.155*a*.

Extreme base of tegmen well preserved, showing the typical Blattoid humeral border, strongly convex. Humeral area 5·5 mm. long, sharply pointed at apex, and carrying a single weakly indicated branch from Sc. Main stem of R giving off seven

primary branches to the anterior border, excluding the forked distal end; of these, the first four are simple veins, the fifth, sixth, and seventh forked. M sends at least seven branches to the apex and below it. Cu sends also at least seven branches to the posterior border; of these the more anterior ones extend far out below the apex, parallel with the lower branches of M. In the area covered by M and Cu, there are strong indications of a somewhat irregular cross-venation.

Raised ridges of considerable breadth separate all the veins, except those on the anal area. These ridges appear at first sight to be the veins themselves; but a closer examination shows that they do not join up basally with one another, whereas the finer veins lying between them do all so join up. Thus these latter must be the true veins, the ridges being probably some specialised development of a series of intercalated veins. The cross-venation, where it is well enough preserved to be studied with advantage, can be seen to lie on either side of each true vein, being interrupted more or less by the intercalated ridges.

Anal area complete, with *vena dividens* strongly marked. Anal veins weakly indicated anteriorly, more strongly posteriorly. A fairly regular cross-venation present almost all over the anal area. First anal vein both arising from and ending upon the *vena dividens*; the second lying close below the first, but ending just below the apex; the third and fourth wide apart, the latter much waved; the fifth close under the fourth, much less curved; below this are five more veins, the first two of which are considerably waved.

Type, Specimen No.155*a*. (Coll. Queensland Geological Survey).

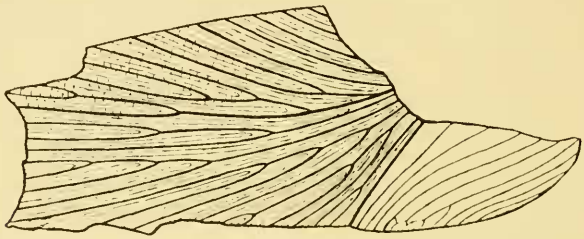
Horizon: Upper Triassic, Ipswich, Q.

SAMAROBLATTA TRIASSICA, n.sp. (Text-fig.35).

A well preserved fragment of a left tegmen, with the greater portion of the base missing, also the apex and a narrow piece along the posterior border.

*Greatest length*, 10·5 mm., representing a tegmen whose total length was about 13 mm. *Greatest breadth*, 4·5 mm.

Closely similar to *S. reticulata*, from which it differs as follows: —Branchings of R, M, and Cu differently arranged, as may be seen by comparing Text-figs. 34 and 35. (Not much stress can be laid on this character, however, since not only different individuals of the same species of Cockroach, but also even the right



Text-fig. 35.

*Samaroblatta triassica*, n.g. et sp. (×7½). Left tegmen. Upper Trias of Ipswich, Q. Drawn from Specimen No. 156.

and left tegmina of the same individual, show considerable differences in this respect). Cross-venation indicated upon the area served by the branches of R, but not upon M, Cu, or the anal area. Anal area with nine anal veins, all ending upon the posterior border; the fourth, fifth, and sixth with small distal forkings, which anastomose with one another; the other anal veins simple.

Type, Specimen No. 156. (Coll. Queensland Geological Survey).

Horizon: Upper Triassic, Ipswich, Q.

Though the costal area is missing, the structure of R shows that this species belongs to the genus *Samaroblatta*.

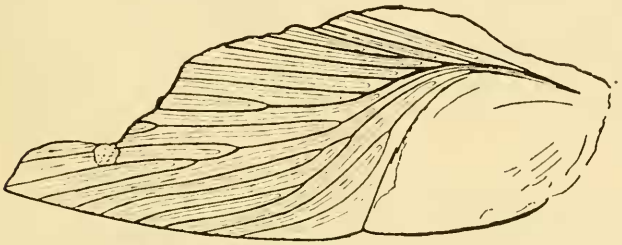
SAMAROBLATTA JONESI, n.sp. (Text-fig. 36).

A fairly well preserved fragment of a left tegmen, with the costal border and apical area missing, most of the posterior border and anal area complete.

*Greatest length*, 11 mm., indicating a tegmen of total length about 13 mm. *Greatest breadth*, 4 mm.

Closely related to the above two species, but distinguished from them as follows:—No cross-venation anywhere indicated;

anal area with only vestiges of anal veins. The veins and intercalated ridges are well preserved, and the form of branching of R, M, and Cu is not unlike that of *S. reticulata*, n.sp. But M had certainly less than seven branches, while Cu, which is completely preserved in this fossil, shows only six.



Text-fig.36.

*Samaroblatta jonesi*, n.g. et sp. (×7½). Left tegmen. Upper Trias of Ipswich, Q. Drawn from Specimen No.157*a*.

Type, Specimens No. 157*a*, 157*b* (part and counterpart). (Coll. Queensland Geological Survey).

Horizon: Upper Triassic, Ipswich, Q.

Dedicated to Mr. A. J. Jones, the present Minister for Mines in Queensland.

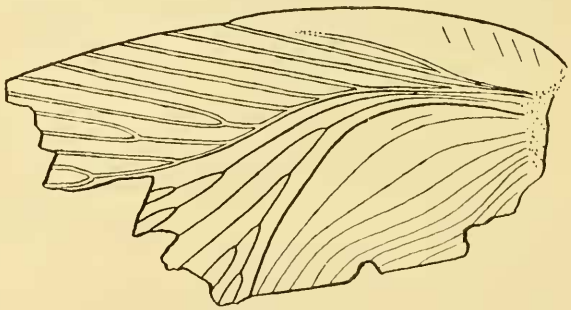
SAMAROBLATTA BLABELLOIDES, n.sp. (Text-fig.37).

A well preserved fragment of a left tegmen, with the apical third missing, broken off along a very irregular line. There are also small portions missing from the anal area and extreme base.

*Greatest length* of fragment, 9·3 mm., indicating a tegmen of total length 13 mm. *Greatest breadth*, 5 mm., being the total breadth of the tegmen.

Costal area fairly wide, sharply pointed at apex, 6 mm in length from base to apex; bounded distally by the straight vein Sc, from which a less distinct branch comes off within the area; slight signs of a series of oblique costal veinlets towards the base. Sc, R and its branches consisting of very thick veins; M and Cu only moderate. Primary branches of R seven, excluding the forked end of the main stem; the first four straight, simple

veins, the fifth forked near its base, the sixth forked further distad, the seventh only partly preserved. So far as preserved, M shows four branches, Cu six. No signs of intercalated veins or cross-veins. Anal area well defined, with strongly marked *vena dividens*, and anal veins unbranched. What is probably the first anal vein is only just indicated by a slight impression near the top of the area; then follow two widely spaced veins, corresponding exactly with the second and third anal veins of *S. reticulata*, n.sp.; below these are about six more veins, closer together, and not quite so irregularly curved as in *S. reticulata*.



Text-fig.37.

*Samaroblatta blabelloïdes*, n.g. et sp. ($\times 7\frac{1}{2}$). Left tegmen. Upper Trias of Ipswich, Q. Drawn from Specimen No.131*b*.

Type, Specimen No. 131*b*. (Coll. Queensland Geological Survey).

Horizon: Upper Triassic, Ipswich, Q.

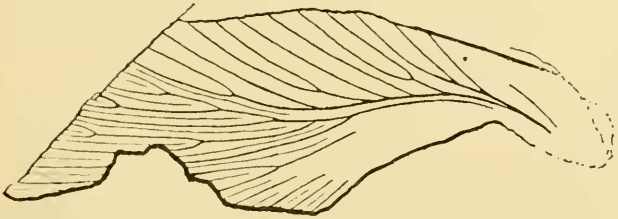
In spite of the difference in the structure of the veins in the region of Sc and R, and the absence of intercalated veins and cross-veins, this species would appear to be closely allied to *S. reticulata*. As far as it is preserved, the branching of R is closely similar in the two species, while the arrangement of the anal veins shows also a very close parallelism.

The specific name has been given on account of the thickened veins in the anterior region of the tegmen, reminding one of the similar condition in the well known genus of recent cockroaches, *Blabella* Caudell (= *Phyllodromia* Serville, preoccupied), of

which the common *B. germanica* (Linn.) is the genotype. A similar condition also exists in the very fragmentary Mesozoic fossil *Pachyneuroblattina rigida* Handl. (1, p.433), in which also the primary branches of R, as far as preserved, exactly correspond with those of our new species. It seems a pity that Handlirsch should have founded a new genus on such a fragmentary type as this, especially as the thickening of the veins may not really be of generic value at all, any more than it is in *Samaroblatta*. Until a more complete specimen is found, it would not be possible to decide the amount of relationship between *Pachyneuroblattina* and *Samaroblatta*.

SAMAROBLATTA INTERCALATA, n.sp. (Text-fig.38).

*Greatest length* of fragment, 10 mm.; *greatest breadth*, 3·3 mm. A fragment of a left tegmen of probably about the average size of those already described in this genus.



Text-fig.38.

*Samaroblatta intercalata*, n.sp. (×7½). Left tegmen. Upper Trias of Ipswich, Q. Drawn from Specimen No.262.

The anal area is missing, and the costal area not clearly preserved, except for a small portion of the costal border. The double-curving of R is strong, and is the one definite character that allows of the species being placed in the genus *Samaroblatta*. The limits of Sc and R basally are not clear; what appears to be the first primary branch of R is itself three-branched, a very unusual condition for *Samaroblatta*. The next branch of R is forked, then follow in order two simple branches, a forked branch, another simple branch and a final branch making a very definite fork with the main stem; thus there are seven primary

branches of R in all, as far as preserved. The veins below R appear at first sight to be very well preserved, but it is not possible to determine the more basal portions of M and Cu with certainty. Intercalated veins are quite absent in the region of R, but are present between every pair of veins in the regions of M and Cu, and are very clearly marked. This character has suggested the specific name.

Type, Specimen No. 262. (Coll. Queensland Geological Survey).

Horizon: Upper Triassic, Ipswich, Q.

Genus AUSTROBLATTULA, n.g. (Text-fig.39).

Small tegmina (less than 10 mm. long), with the humeral area, if anything, slightly longer from base to apex than is the anal area. Sc apparently fused with R basally, and consisting of a single, straight vein bordering the humeral area distally. R bent near base, then almost straight for most of its length, curving slightly upwards towards the apex. Anal area somewhat cultriform, more than usually broad; the anal veins apparently unforked (indistinctly preserved).

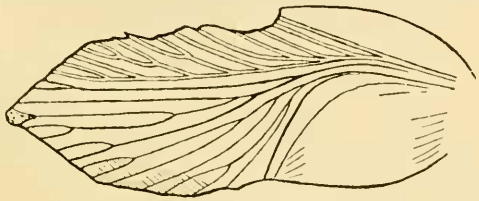
Genotype, *Austroblattula ipsviciensis*, n.sp. (Upper Trias of Ipswich, Q.).

This genus comes fairly close to *Mesoblattina* Geinitz, from the Lias of Dobbertin, Mecklenburg, but may be distinguished from it by its larger humeral area, not crossed by any branch of Sc, by its broader anal area, and by the absence of intercalated veins. From *Mesoblattula* Handl., another genus of small cockroaches from the same beds, it can be at once separated by the absence of the strong double-curving of R, as well as by its larger humeral and anal areas, and by the absence of intercalated veins. It agrees with *Triassoblatta* in lacking this strong double-curving of R, but differs from that genus in its much larger humeral area (in comparison with its size), its strongly reduced Sc, its much more strongly curved *vena dividens*, and its much smaller size. The differences between it and *Samaroblatta*, apart from its size, are indicated in the generic key already given.

Austroblattula ipsviciensis, n.sp. (Text-fig.38).

A small left tegmen with the whole of the basal portion preserved, but parts of the anterior, apical, and posterior margins missing.

*Greatest length* of fragment, 7·5 mm., indicating a tegmen of total length about 9 mm. *Greatest breadth*, 3·3 mm.



Text-fig.39.

*Austroblattula ipsviciensis*, n.g. et sp. (×7½). Left tegmen. Upper Trias of Ipswich, Q. Drawn from Specimen No.105*a*.

Humeral area of moderate width, without veins or markings of any kind. Sc a straight, simple vein, bounding the humeral area distally. Main stem of R giving off eight primary branches, exclusive of its apical continuation; of these the first two are simple veins, the third forked near its base, the fourth simple, the fifth forked, the sixth three-branched, the seventh and eighth simple (as far as preserved). Sc, R and its branches are formed of strong, thick veins, as in *Samaroblatta blabelloïdes*, n.sp.; M and Cu are only moderately strong veins, each of which gives off seven branches to the wing-border. *Vena dividens* very strongly arched; the first anal vein complete, simple, ending on the posterior border just below the apex of the area; the other anal veins only partially indicated towards their bases and apices.

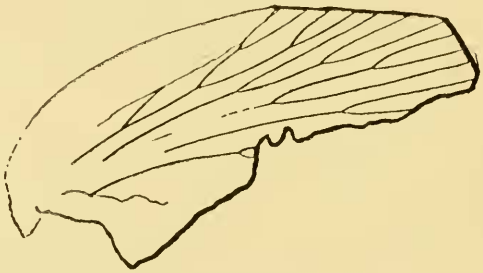
Type, Specimens No. 105*a*, 105*b* (part and counterpart). (Coll. Queensland Geological Survey).

Horizon: Upper Triassic, Ipswich, Q.

Blattoidea incertæ sedis.

*Specimen No.152* (Text-fig.40). A fragment of a cockroach tegmen, about 8 mm. long, and showing very clearly a number of branching veins, and apparently also the outline of the costal

border of the humeral area above them. If the most anterior of the preserved veins be Sc, as appears very likely, then this fossil must belong to a more archaic group than the *Mesoblattinidæ*, seeing that Sc appears to have retained its primitive branched condition and has remained of considerable length. The affinities of this specimen are quite uncertain, and it does not seem to me to be complete enough to merit a name.



Text-fig.40.
Specimen No.152 (×7½).

*Specimens No.121a, 121b* (part and counterpart). These represent fragments of a cockroach tegmen, very indistinctly preserved, and not well enough characterised to merit a name. The basal half or more of the tegmen is shown, with most of the anal area. The venation is indistinct, except for Sc and some of the branches of R, which appear to be thick, strongly formed veins. Length, 6 mm.; greatest breadth, 3 mm.

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1. Handlirsch, A., 1908.—"Die fossilen Insekten, etc." Leipzic, 1908.
2. Tillyard, R. J., 1916.—"Mesozoic and Tertiary Insects of Queensland and New South Wales." Queensland Geological Survey, Publication No.253. Brisbane, 1916.